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ABSTRACT

It is hypothesized that children with hyperkinesis tend to repeat inappropriate behavior patterns more frequently than do other children. To assess this tendency to perseverate, a new scoring method using the Porteus Maze Test was devised. On a limited sample of children diagnosed as hyperkinetic and not hyperkinetic, analyses indicate that the measure differentiates between the two groups. Hyperkinetics were divided into two treatment groups and medicated either with Ritalin or with a placebo. Changes in test scores indicate that children treated with Ritalin show significantly more improvement than children on a placebo. (Author)

Development of a Score that Separates Hyperkinetic and Normal Children and Demonstrates Drug Effect

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The research staff at Gateways Hospital in Los Angeles is conducting studies on hyperkinetic children. Hyperkinesis is a childhood behavior disorder characterized by excessive activity, low frustration tolerance, aggressivity, impulsivity, inability to postpone gratification, poor school performance, classroom disturbance, poor peer relationships, and hostility (Stewart, 1970; Werry, 1968). It is hypothesized that hyperkinetic children tend to perseverate by repeating, in a problem-solving task, an inappropriate behavior pattern more frequently than do other children. Since it has been found that chemotherapy produces beneficial effects in hyperkinetic children (Conners and Eisenberg, 1963; Millichap, 1968), it is further hypothesized that when hyperkinetic children are medicated, the ability to modify behavior (shift) increases. In order to test these two hypotheses, a quantitative measure was sought which would reflect the ability to terminate unsuccessful behavior and produce a changed response in order to solve a problem.

In many standardized tests there are tasks in which the subject must select a method of approach where several alternatives and opportunities are presented. To find an appropriate instrument, certain criteria were established. As our sample consists of children from six to ten years of age,

some of whom have severe learning disabilities, we searched for tasks appropriate for pre-literate children which do not contain numerical or alphabetical symbols. Tasks should not be contaminated by emotional factors, so tests simulating class-room situations were avoided. Tasks should give the child freedom to either repeat a pattern or to select a new approach.

With these criteria in mind, numerous well established standardized tests and test items were evaluated. The Koppitz method of scoring the Bender Motor Gestalt Test yields a perseveration score. This score, however, is based on continuation of activity past an appropriate level rather than on repetition of behavior after an interruption of the task. The age-level format of the Binet, where children of different ages are given different tasks, eliminated it from consideration. Three subtests on the Wechsler Intelligence Scale for Children (Picture Arrangement, Block Design, and Object Assembly) allow decisions to be made on the manipulation of pieces in a part-whole relationship. Standardized scoring reflects the ability to minimize wrong moves. Repetitions, however, are not recorded, and in all three cases the scoring is within time limitations. Other methods of scoring these items were experimented with, but it was concluded that the memory of the examiner was a variable that could not be controlled. Accuracy could only be ensured by filming test administration and scoring each item after the testing session. Neither equipment nor personnel were available for such a project.

The instrument selected for testing the hypotheses on inappropriate behavior patterns was the Porteus Maze Test. This is a power test which gives a subject 22 chances on eight mazes. Figure 1 presents the most difficult of the mazes administered. The Porteus Maze is a test which is noted for its sensitivity to drug effects (Aaronson, 1963; Porteus, 1965).

Under the standardized instructions, two trials are possible on five mazes, beginning with Year VII, and four trials are possible on each of the three most difficult mazes. Practice effects are minimized by administering two series of mazes; the Vineland Revision on pretest and the Porteus Maze Extension on retest. When the subject fails the test, the maze is removed and an unmarked copy of the maze is presented. This provides feedback. Since the child's pencil mark leaves a record of his performance, it is possible to analyze each move that he makes and a score of the number of repetitive errors can be calculated.

A scoring system was devised as follows: when the initial trial is unsuccessful and if on a subsequent attempt the subject replicates all of the same wrong turns he made before, he receives a score of two; if he replicates any of the same wrong turns he made before, he receives a score of one; if he does not replicate any of the previous wrong turns, he receives a score of zero. Scores for each year level were totalled to obtain a Perseveration Error Score.

The sample of children analyzed in this report were 57 males between the ages of six and ten. Fifty-four were caucasians, 1 was Negro, and 2 were Mexican-American. Of these, 32 were diagnosed as hyperkinetic and 25 were diagnosed as not hyperkinetic. Only children who received I.Q. scores of 80 or above on the Peabody Picture Vocabulary Test and who were without obvious sensory defects were included in the sample.

A battery of standardized tests was administered individually to the children. These included the Peabody Picture Vocabulary Test, the Wechsler Intelligence Scale for Children, the Bender Motor Gestalt Test, the Illinois Test of Psycholinguistic Abilities, the Wide Range Achievement Test, the

Goodenough-Harris Drawing Test, the Lincoln-Oseretsky Motor Development Test, and the Porteus Maze Test. Children diagnosed as not hyperkinetic were tested once to provide a basis for comparison of performance. The children diagnosed as hyperkinetic were tested before treatment (pretest), then randomly assigned to one of two treatment groups. Group One was placed on Ritalin (methylphenidate), and Group Two was placed on a placebo. Those on Ritalin received an initial dosage of 10 milligrams at morning and at noon, and dosages were adjusted as medically indicated during the next three weeks. On the twenty-third day of medication, posttests were administered to the two hyperkinetic groups.

Considering the total sample of 32 hyperkinetics on pretest compared to the 25 controls, certain significant differences were found. The mean of perseveration errors on the Porteus Mazes for hyperkinetics was 6.8, and that for controls was 1.8, which is significant at the .01 level ("t" test*).

In this particular group of controls and hyperkinetics, however, significant differences were found on 56 of the 90 variables tested, including the Peabody I.Q. ($p > .01$), and the WISC Total I.Q. ($p > .001$), Verbal I.Q. ($p > .01$) and Performance I.Q. ($p > .001$). It was felt that a general intelligence factor might be a major variable effecting the statistics.

There were two subsamples analyzed. The first matching was done between the controls and the hyperkinetic children on pretest on the bases of age and of I.Q. on the Wechsler Intelligence Scale for Children. A sample of 28 children was obtained, 14 of whom had been diagnosed as not hyperkinetic and 14 of whom had been diagnosed as hyperkinetic by two child psychiatrists. The mean chronological age for the 14 controls was 92.7 months, and that for

* Computing assistance was obtained from the Health Sciences Computing Facility, UCLA, sponsored by NIH Special Resources Grant RR-3.

the hyperkinetics was 92.9 months. The mean total I.Q. on the WISC was 110.4 for the controls, and that for the hyperkinetic children was 109.1. Neither the age nor the I.Q. score was significantly different between the two groups.

When subjects were closely matched by age and I.Q. the number of significant differences dropped from 56 to 2, indicating that most of the differences found between the hyperkinetic and control groups in the total sample of 58 subjects were probably a function of I.Q. and maturation. In these matched groups, the two scores showing a statistical difference were the Porteus Test Quotient ($p > .05$) and the Porteus Perseveration Error Score ($p > .01$). The posttest mean of the Porteus Maze Perseveration Errors for the controls was 2.6, and that for the hyperkinetics on pretest was 7.6. This difference between controls and hyperkinetics on pretest on the Perseveration Error Score was similar with both matched and unmatched groups. These data present evidence to confirm the first hypothesis.

Since evidence had been obtained that measuring the perseveration errors on the Porteus Maze Test, as defined in this paper, did distinguish between hyperkinetic children and children diagnosed as not hyperkinetic, information was sought as to whether the administration of Ritalin, as opposed to administration of a placebo, would result in significant differences in the perseveration score. At this point further matching was done to obtain the second subsample, consisting of 14 controls, 14 hyperkinetic children receiving Ritalin, and 14 hyperkinetic children on placebo. This matching also was done by chronological age and by I.Q. on the Wechsler Intelligence Scale for Children. The pretest mean Total I.Q. scores on the WISC were 107.2 on the sample of controls, 103.6 for the Ritalin subjects, and 103.3 for the placebo sample. Mean chronological ages for the groups were 91.0 months for controls, 90.7 months for those on Ritalin, and 94.5 months for those on a placebo. On comparing the two hyperkinetic groups on the Perseveration Error Score on pretest no significant difference was found.

Table 1 presents the means and standard deviations of pretest and posttest on the newly developed Porteus Maze Perseveration Error Scores for each of these three groups.

TABLE 1

Perseveration Error Scores on the Porteus Maze for the three matched groups.

	Ritalin		Placebo		Controls
	Pre	Post	Pre	Post	(Test)
M	8.1	3.6	6.5	6.1	2.5
SD	4.0	3.8	5.7	4.1	3.0
N	14		14		14

Three sets of analyses ("t" tests) were made to test the second hypothesis. The first set was to compare the posttest scores of hyperkinetics with controls. This could demonstrate an approach to normal of the Ritalin group. There was no significant difference between controls and the posttest on children treated with Ritalin. However, the posttest scores for the placebo group remained significantly different ($p<.01$) from controls.

The second set of analyses compared the two hyperkinetic groups. On pretest the scores of the group receiving a placebo were somewhat lower than those of the Ritalin sample. When the two sets of posttest scores were compared, although the mean of the Ritalin group was lower, there was no significant difference between the means of the two groups.

The third set of analyses involved comparing pretest and retest scores for each of the hyperkinetic groups. For the group on Ritalin there was a significant drop in means on the Perseveration Error Score ($p>.01$) from 8.1 on pretest to 3.6 on posttest. For the placebo group no significant difference was found between pretest and posttest. The pretest mean was 6.5 and the posttest mean was 6.1. These analyses indicate that hyperkinetic

children after medication with Ritalin obtain lower perseveration scores on posttest and approach their controls in performance.

It should be noted that the total mean I.Q. scores on the WISC on pre- and posttest showed no statistically significant difference for the placebo group. Scores on pretest were 103.3 and on posttest were 106.4. Although statistical difference was not found between the mean pre- and posttest WISC total scores for the Ritalin group, scores increased from 103.6 to 112.9. This shows a trend and approaches statistical significance ($p=.07$).

While poor problem-solving performance has long been observed in hyperkinetic children, it has generally been attributed to short attention span and distractability. The data obtained in this study suggest that the lack of control may be due in part to repetition of the same wrong solution to a problem, and that this is one aspect of performance which differentiates hyperkinetic from normal children.

Based on a limited sample, it appears that the Perseveration Error Score developed for use with the Porteus Maze Test does differentiate between hyperkinetics and controls, and that evidence has been obtained that children with hyperkinesis do tend to repeat the same inappropriate behavior pattern more frequently than do children who are not hyperkinetic. It also appears that hyperkinetics medicated with Ritalin show significantly more improvement (less perseveration) than do those placed on a placebo. Enlargement of the sample will contribute further information.

References

Aaronson, B. S. The Comparative Sensitivity of the Qualitative and Quantitative Porteus Maze Scores to Drug Effects. J. of Clin. Psych., 1963, 19, 184.

Conners, D. K., & Eisenberg, L. The Effects of Methylphenidate on Symptomatology and Learning in Disturbed Children. Am. J. Psych., 1963, 120, 1458.

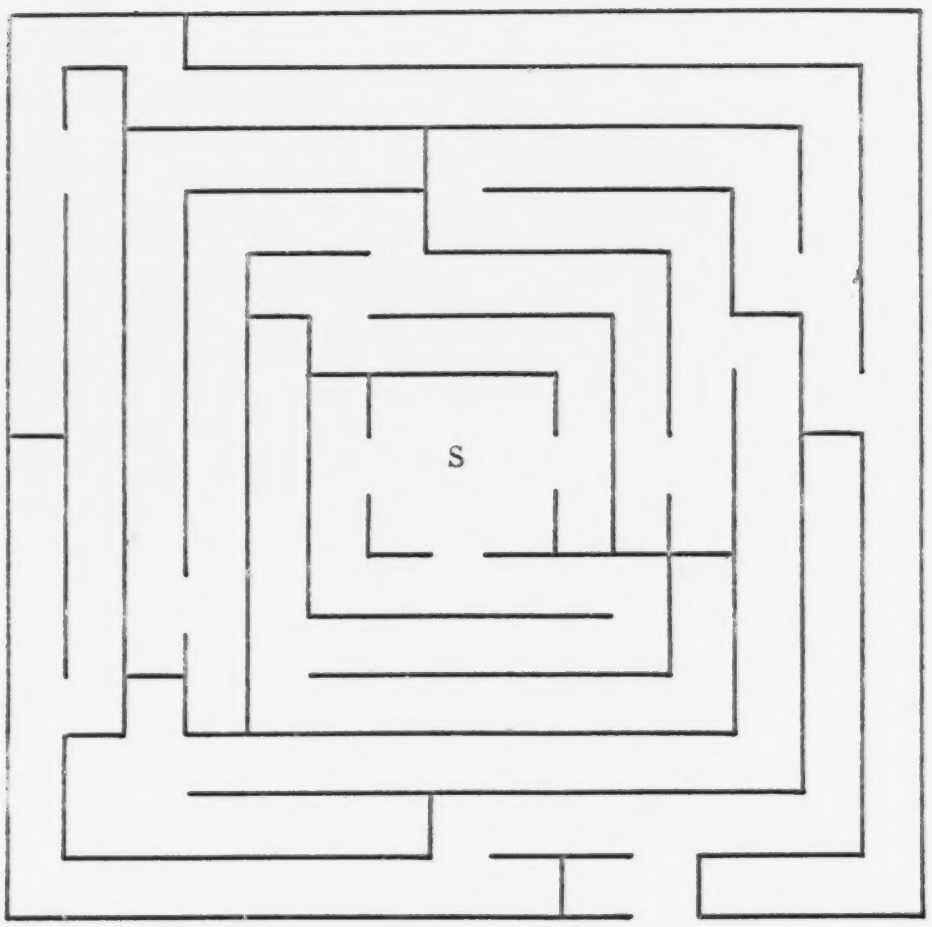
Millichap, J. C. Drugs in Management of Hyperkinetic and Perceptually Handicapped Children. J. A. M. A., 1968, 206, 1527.

Porteus, S. D. Porteus Maze Tests: Fifty Years Application. Pacific Books, Palo Alto, California, 1965.

Stewart, M. A. Hyperactive Children. Scientific American, April 1970, 94.

Werry, J..S. Developmental Hyperactivity. Ped. Clinics of No. Am., 1968, 15, 581.

Figure 1



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